

Docket No. 520.43596X00
Serial No. 10/791,823
Office Action dated August 4, 2006

REMARKS

I. Introduction

By the present Amendment, claims 1 and 5 have been amended. No claims have been added or cancelled. Accordingly, claims 1-8 remain pending in the application. Claims 1 and 5 are independent.

II. Office Action Summary

In the Office Action of August 4, 2006, claims 1-8 were rejected under 35 U.S.C. §112, first paragraph. Claims 1-4 and 6-8 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,572,538 issued to Saitoh, et al. ("Saitoh"). Claims 1 – 8 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,309,319 issued to Messina in view of Saitoh. These rejections are respectfully traversed.

III. Rejections Under 35 USC §112

Claims 1-8 were rejected under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventors had possession of the claimed invention at the time the application was filed. With respect to this rejection, the Office Action alleges that the claimed subject matter of the ion exchange bag being freely disposed in the cooling liquid accumulated within the tank and freely disposed in the piping are not supported by the original disclosure.

By the present Amendment, claims 1 and 5 have been revised, in part, to address the issues raised in the Office Action. For example, independent claim 1 has been amended to recite that water-permeable bag is disposed in the cooling

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liquid accumulated within the tank. This is illustrated, for example, in the Figs. 15 and 16. Additionally, independent claim 5 has been amended to recite that the ion exchange bag is disposed in the piping. This particular feature is illustrated, for example, in Figs. 13 and 14.

It is therefore respectfully submitted that, as amended, the presently pending claims satisfy the written description requirements 35 U.S.C. §112, first paragraph.

IV. Rejections under 35 U.S.C. §102

Claims 1-4 and 6-8 were rejected under 35 U.S.C. §102(b) as being anticipated by Saitoh. Regarding this rejection, the Office Action states that Saitoh discloses a liquid cooling system that comprises a pump for supplying a cooling liquid, a heat-receiving jacket, a radiator, and flow passages for circulating the cooling liquid in a route passing through the radiator. The Office Action further alleges that Saitoh discloses a tank for accumulating the cooling liquid circulating within the flow passages, and an ion exchange bag that is disposed within the cooling liquid accumulated within the tank. Applicants respectfully disagree.

As amended, independent claim 1 defines a liquid cooling system for use in an electronic apparatus that includes a heat-generating element therein. The liquid cooling system comprises:

- a pump for supplying a cooling liquid;
- a heat-receiving jacket, being supplied with said cooling liquid, for receiving heat from the heat-generating element;
- a radiator, being supplied with said cooling liquid passing through said heat-receiving jacket, for radiating heat therefrom;
- flow passages for circulating said cooling liquid in a route passing through said radiator back to said pump, said flow passages including parts that generate corrosive ions therefrom; and

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a tank for accumulating said cooling liquid circulating within said flow passages, wherein:
the cooling liquid contained within said system is less than or equal to one liter in volume,
an ion exchange bag, having water-permeable surfaces, encloses an ion exchange resin therein, and is disposed in the cooling liquid accumulated within said tank, and
said ion exchange bag enables ion exchange through diffusion on almost all water-permeable surfaces thereof.

According to independent claim 1, the liquid cooling system includes a pump, a heat-receiving jacket, a radiator, flow passages, a tank, and an ion exchange bag. The pump is used for supplying a cooling liquid, while the heat-receiving jacket receives heat from the heat-generating element. The radiator is used to remove heat from the cooling liquid. Flow passages are used to circulate the cooling liquid in a route that passes through the radiator and back to the pump. Additionally, the flow passages include certain parts that generate corrosive ions. The tank is used to accumulate the cooling liquid being circulated within the flow passages. The ion exchange bag is provided with a water-permeable surface and disposed in the cooling liquid accumulated in the tank. Furthermore, the ion exchange bag contains an ion exchange resin and enables ion exchange through diffusion on the water-permeable surfaces. According to the liquid cooling system of independent claim 1, the volume of cooling liquid contained in the system is less than or equal to one (1) liter. As discussed in the specification, the present invention is designed for use with small electronic devices such as laptop computers. Thus, only a small volume of cooling liquid is preferred. See page 9, lines 28-31.

The Office Action alleges that Saitoh discloses all of the elements of independent claim 1. In response to Applicants' previous arguments, the Office

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Action further alleges that the features relied upon for patentability are not recited in the claims. Accordingly, independent claim 1 has been amended to recite some of these features.

Saitoh discloses a laser apparatus and a cooling system therefor. The cooling system of Saitoh is configured as a large unit that is totally incapable for use as a cooling system for small electronic devices, such as, for example, a laptop computer. The amount of cooling fluid required in the system of Saitoh would exceed 1 liter. Thus, the system of Saitoh cannot be construed as enabling the claimed invention.

The structure of the cooling system in Saitoh also differs from the claimed invention. In particular, Saitoh requires a pump having sufficient capacity to circulate all of the cooling fluid and also generate enough pressure to force the coolant through the tubular container that stores the ion exchange resin. See for example, col. 8, lines 43-56.

In contrast, for example, the ion exchange bag of the claimed invention has water-permeable surfaces and is disposed in a quantity of cooling liquid that is less than or equal to 1 liter. The present invention is directed to small electronic devices such as laptop/notebook computers, projectors, that require significantly less coolant volume and circulation/flow. Further, the heat-generating elements in such devices are typically in the form of electronic components such as CPUs, chips, etc. As discussed in the specification, it is difficult to effectively cool such small electronic devices because of the small quantity of liquid coolant present in the system relative to the levels of corrosive ions that are being generated within the flow passages. Furthermore, the size of the electronic device restricts the size of the pump and flow restriction in the coolant path. More particularly, the rate of flow and pressure that

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exist in the system are relatively low. Accordingly, difficulties arise when ion exchange must take place.

The present invention provides an arrangement wherein the ion exchange bag is positioned within the tank, thereby being capable of some movement within the tank to improve the exchange of ions. Additionally, the size of the ion exchange bag is small relative to the volume of the tank. Accordingly, it is possible for ion exchange to take place even when the electronic device is turned off and the pump is not working, because the ion exchange bag can move freely within the tank.

This configuration vastly differs from that of a laser device such as disclosed in Saitoh. Saitoh is in an entirely different field of endeavor, and does not even recognize the problems associated with cooling small electronic devices. It is therefore not clear how Saitoh could possibly provide a solution to the problems associated with cooling electronic devices. It is more likely that Saitoh would employ a larger capacity pump, or increase the level of coolant in the system, to address any issues of overheating in the laser apparatus. Additionally, the arrangement provided by Saitoh is ineffective at removing ions when the system is turned off. As illustrated in Fig. 4, the ion exchanger is positioned in a stationary manner and only operates when coolant is forced through under pressure. If the system is turned off, ions present in the tank cannot be filtered by the ion exchanger.

It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

Claims 2-4 and 6-8 depend from independent claim 1, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 1. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

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V. Rejections under 35 U.S.C. §103

Claims 1-8 were rejected under 35 U.S.C. §103(a) as being unpatentable over Messina in view of Saitoh. Regarding this rejection, the Office Action asserts that Messina discloses an electronic apparatus that includes most of the elements recited in independent claims 1 and 5. The Office Action admits that Messina does not disclose an ion exchange bag held within a container located upstream of the heat-receiving jacket and downstream of the radiator. The Office Action further notes that the use of an ion exchanger and filter is well known to be incorporated into the cooling system. Saitoh is relied upon for disclosing a cooling system having an ion exchange bag.

As admitted in the Office Action, Messina does not disclose an ion exchange bag located upstream of the heat-receiving jacket and downstream of the radiator. The Office Action further notes that the use of an ion exchanger and filter is well known to be incorporated into the cooling system. Saitoh is relied upon for disclosing a cooling system having an ion exchange bag. Applicants respectfully disagree.

As previously discussed, Saitoh fails to disclose a cooling system wherein the volume of cooling liquid contained therein is less than or equal to one (1) liter. This particular feature is also not suggested by Saitoh. Saitoh discloses a system designed for cooling a laser apparatus which, in and of itself, is entirely different from the claimed invention or Messina. Such systems typically require large quantities of cooling fluid and high volume pumps. Thus, even if Messina and Saitoh were properly combinable they would still fail to disclose all the features recited in the claimed invention, including "the cooling liquid contained within said system is less than or equal to one liter in volume."

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It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

Claims 2-4 and 6-8 depend from independent claim 1, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 1. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

As amended, independent claim 5 defines an electronic apparatus that comprises:

- a heat-generation element mounted on a substrate;
- a heat-receiving jacket, being thermally connected to said heat-generation element;
- a heat radiation jacket for radiating heat of a heated liquid supplied from said heat-receiving jacket;
- a pump for circulating the liquid to those jackets;
- and
- a piping for connecting said pump and said both jackets, wherein:
 - the cooling liquid contained within said system is less than or equal to one liter in volume,
 - an ion exchange bag, having a water-permeable bag enclosing ion exchange resin therein, is disposed in said piping, and
 - said ion exchange bag enables ion exchange through diffusion on water-permeable surfaces thereof.

Independent claim 5 recites limitations that are somewhat similar to those recited in independent claim 1. For example, independent claim 5 provides that the cooling liquid contained within the system is less than or equal to one liter. As previously discussed with respect to independent claim 1, the applied references fail to disclose such features

It is therefore respectfully submitted that independent claim 5 is allowable over the art of record.

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VI. Conclusion

For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.


If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

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AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 520.43596X00).

Respectfully submitted,
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